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Price Discrimination With Unequal Costs

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1. Introduction

The traditional theory of price discrimination states that when the firm faces two markets with differing elasticities of demand, it can maximize revenue by selectively allocating the product between the alternative markets until the respective marginal revenues are equal to each other and to marginal cost. Aggregate marginal revenue then equals marginal cost.^{1/}

This relationship, however, implicitly assumes that the costs of selling in each market are equal. In real life, this is unlikely to be the case. The cost of marketing fresh apples, for instance, is apt to be less than the cost of marketing processed apples. How, then, is the firm or industry to take differing costs into account?

2. The General Relationship

The answer is to try to equalize marginal net revenues in the two markets. Marginal net revenue is considered to be the equivalent of marginal revenue minus marginal cost. The equating of marginal

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^{1/} See, for example, Richard Leftwich, The Price System and Resource Allocation, Rinehart & Co., New York, 1958, pp. 212-215.

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net revenues in two markets then involves the following relationship:

$$MR_a - MC_a = MR_b - MC_b$$

where MR_a and MC_a refer to market (a) and MR_b and MC_b refer to market (b).

While this equation presents the fundamental relationship, its solution may not immediately be clear. Assuming that data is available on marginal costs and marginal revenue, the quantity to be placed in each market may be determined graphically or algebraically.

3. Graphic Solution

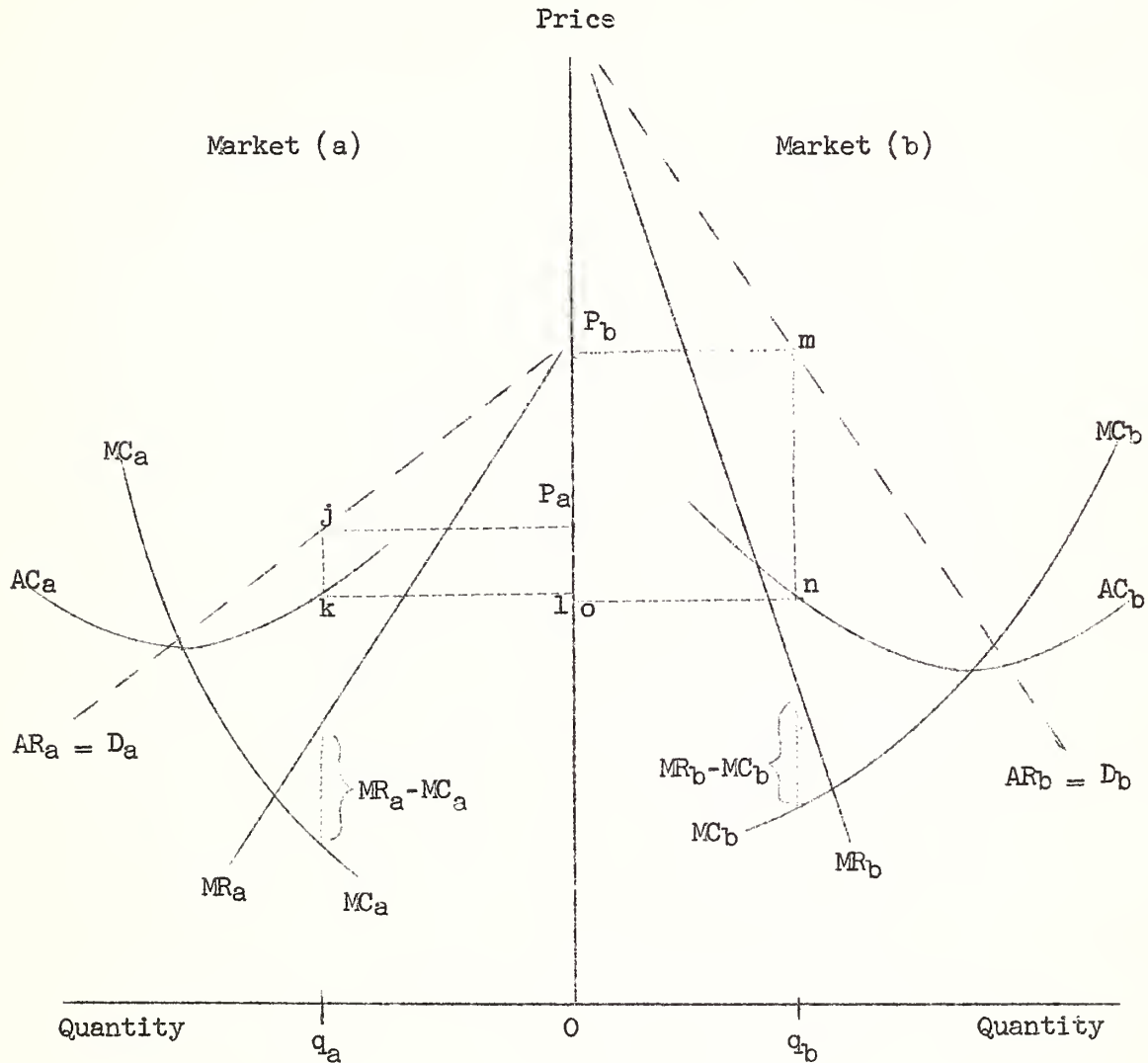
The basic relationships are presented graphically in figure 1.^{2/}

It is assumed that the industry has a given quantity (Q) to be marketed which is less than the quantity which would equate marginal revenue and marginal cost in each market.^{3/} It is further assumed that market (a) has the more elastic demand schedule as well as higher average and marginal costs; market (b) is assumed to have a more inelastic demand and lower average and marginal costs. In the case of apples at the retail level, for instance, we might consider (a) as the processed market and (b) the fresh market.

^{2/} An alternative and more general formulation, suggested by Carleton Dennis, would be as follows: (1) Starting with two or more conventional sets of MR & MC curves, plot a Net Marginal Revenue (NMR) curve for each set by subtracting MC_1 from MR_1 over a series of quantities; (2) take the individual NMR curves and add them horizontally (just as Leftwich op. cit., p. 214⁷ adds MR curves); (3) place a vertical supply curve at the point which indicates the total quantity available; (4) from the point where the supply curve intersects NMR, draw a horizontal line to the Y axis. The point where this line intersects each NMR curve indicates the quantity to be placed in each market.

^{3/} If the quantity were greater than this amount, the relationship would be reversed and the quantity to be placed in each market to minimize the reduction in profit would be: $MC_a - MR_a = MC_b - MR_b$.

Figure 1. Price Discrimination With Unequal Costs.



Net Profits will be maximized when q_a units of the product are placed in market (a) and q_b units are placed in market (b). These points were determined graphically by selecting quantities of each which would equate marginal net revenue. At these points, the price in market (a) is P_a and the price in market (b) is P_b . The total profit is represented by a combination of rectangles $P_a j k l$ and $P_b m n o$.

4. Algebraic Solution

The point of maximum profit could alternatively have been determined algebraically.^{4/} The same assumptions are made as in the previous case. In this instance, however, the marginal revenues and costs are given algebraically in terms of slopes. The derivation of the point of maximum net profit takes the following path.

$$(1) \quad MR_a - MC_a = MR_b - MC_b$$

(2) Assume

$$MR_a = 20 - 2q_a$$

$$MC_a = .10q_a + 4$$

$$MR_b = 25 - 3q_b$$

$$MC_b = .08q_b + 5$$

Substituting,

$$(3) \quad (20 - 2q_a) - (.10q_a + 4) = (25 - 3q_b) - (.08q_b + 5).$$

This reduces to

$$(4) \quad 2.1 q_a = 4 + 3.08q_b.$$

$$\text{Since } q_b = Q - q_a$$

$$(5) \quad 2.1q_a = 4 + 3.08 (Q - q_a).$$

This reduces to

$$(6) \quad q_a = .59Q - .77.$$

This means that 59% of the total quantity, less .77 units, should go into market (a) and the rest to market (b).

^{4/} Adapted from G. G. Quackenbush, "A Brief Review of Firm Theory in Marketing," Michigan State University, Department of Agricultural Economics, unpublished and undated paper, p. 12.

The specific quantities going into each market (q_a and q_b) could then be determined by inserting the actual value of Q .

5. Some Limitations

The foregoing solutions are, in a sense, theoretical. They assume that data are available on marginal revenues and marginal costs. These data may not be readily, if at all, available. Before the solutions can be subjected to empirical use, therefore, much further statistical material may have to be gathered.

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